# SUPPLEMENT.

# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

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## Original Correspondence.

### LECTURES AT THE ROYAL SCHOOL OF MINES.

#### MR. N. ENNOR'S REMARKS ON MR. W. SMYTH'S LECTURES FOR IMPROVING MINING SCIENCE—NO. II.

Sir,—There are points of sterling worth connected with *lodes, veins, cross-courses*, and *elvans;* but before putting any questions on these subjects I will give my views as to what is their utility in the earth, and to make my explanation clearer I will endeavour to show the difference between a *lode*, a *cross-course*, and an *elvan*, with their dip and direction. What I term lodes are those that run nearly east and west, some dipping north and others south. Cross-courses are those that run nearest to north and south, varying in dip; and elvans run nearer east and west than to the north or south, but seldom parallel with a lode for any great distance. Their use, to me, is this—they are the Earth's working passages; they were formed with the earth and grew with the earth, as the veins, arteries, and ligaments do in the young child, they grow with it. *Nature*'s laws and works could not be carried on in the earth without them any more than in the young child, and all creatures are formed under one and the same law, and are only the emblem of the Earth's own law, without which nothing in creation could work for a single day. Every well-defined lode, cross lode, and elvan *crosses* the *stratification* more or less. *Elvans* also manage from some law to cross the stratification obliquely, seldom crossing at right angles. Cross-courses are generally continuous for great distances, or, for anything man knows to the contrary, through the whole earth. They have an average dip of about 23½° (just as the *sun* varies from winter to summer), and if they keep this direction throughout it leaves about one-third of the earth's centre remaining as an axis, or a central laboratory. These cross-courses commonly resist every *lode, elvan,* and *stratification* of rock in the whole earth, and it is through these courses the water passes, and I say electricity—and I should like our friends to say if electricity and life must not pass through them, as they are the only direct communications the earth appears to have; and if they are continuous they must pass through the earth from one side of the globe to the other. And I wish it to be observed that those which dip east with us dip west the other side, which accounts for the north and south dips we find. If I am correct as to these lodes passing through the globe leaving one-third as an axis—or, as some pretend, space for a mass of fire—it would be, as before suggested, natural to suppose they all contained hot water, which I have never seen in them, from this cause—hot water might be, and is, found in them where they cross east and west lodes that contain large mineral deposits formed up against them; but all the hot water I have ever seen is unbottomed when man *robs* the lode of its ores. This is a point I wish to direct Mr. W. Smyth's attention to, fearing he has not scrutinised it so closely as I have.

The east and west lodes are the *ore*-bearing ones, and all run across the earth's axis, but are not often continuous, further than from cross-course to cross-course, by which in nearly every case they are mastered, frequently cutting them off altogether, and in other cases shifting them out of their line more or less, some being shifted a considerable distance. Then, these lodes cannot go deep into the earth before they become amalgamated with each other, or with cross-lodes, and may at surface be aptly compared with the branches that shoot from trees. These lodes bear nearly all the mineral fruit of the earth, in which it crystallises when it meets with oxygen near the earth's surface, and, like the fruit on trees, is borne on the extremities of the trees' branches.

Elvans are massive, and more continuous than are lodes, crossing nearly every lode and stratification, whether granite, clay, slate, or whatever rock falls in their way. They go into the earth at about the same angle as lodes, but are from 50 to even 100 ft. wide, having a granite-like appearance, and are, in fact, frequently mistaken for fine-grained granite. They are not very porous, passing but little water through them, and contain traces of metallic ore *only* about the spots where they cross lodes, although they appear to have an extraordinary effect on the lodes, causing them to be productive wherever they are crossed by them. I am sorry that in our school laboratories the contents of the elvans have not yet been discovered, or, if so, that there has not been published a good treatise on them, Mr. W. Smyth, I am sure, must be aware of their good effects when they cross lodes; for example, see the Cornish copper mines.

Having, I think, sufficiently described cross-courses, lodes, and elvans, I will proceed to put my questions, hoping they may be the means of eliciting something beneficial to guide the miner in his earthy researches, and thereby aid future generations.

1.—Why and by what means do cross-courses shift one east and west lode from a straight line 1000 feet in a north or south direction, whilst it moves the next lode only 10 feet, the next *vice versa?* I will give one instance—Devon Consols, where the rich lode is shifted 450 feet south; and Mr. Hitchins informs me that Capel Tor, a side lode, a few fathoms off, is shifted but very slightly; and I know of many lodes where the same cross-course has passed through them with little or no shift or move; but I know of no two distinct lodes being shifted the same distance by the same cross lode. I have observed that the underlie of a lode often alters the direction and distance of the "move." If Mr. W. Smyth has turned his attention to this, probably he will give the public his views of how it took place, about what *era* it happened, and whether it was a sudden move; or are there moves still slowly taking place from the growth and decay of rocks, that on one side of the lode growing, and the other decaying? Some definite conclusion on this subject is wanted, as it being an every-day occurrence its law should be laid before the miner, as these moves baffle him. In his efforts to find the corresponding part he often spends all the company's available cash, and they abandon the mine. Surely this is a case where the miner needs the aid of scientific men, but he finds no one to tender it, and is left to grope in the earth as best he can. These are facts known to Mr. Smyth.

Before leaving this subject I will show its effects in *coal* mines. Coals may be called stratified, and here some beds are frequently shifted over 1000 feet, up or down, whilst others shift but a few feet; and there is this great difference from mineral lodes, they being horizontally shifted, whereas coal beds are moved perpendicularly. The coal miner is not so much thrown out as the metallic miner, as he has the similarity of the layers or strata on the opposite side to guide him; still they are often put out by these (what they call) faults; and seeing these things occur every day causes me to put these questions, and ask the aid of England's paid men to bring science to bear on these subjects, and to lay down a law for the miner's guide. I do not believe Nature made a single error in any of these shifts or moves; and as it is admitted by all geologists that no error has been made in the laying down the earth's stratification, she never having put No. 9 in the place of No. 6, or No. 6 in the place of No. 10, who has a right to accuse her of error in these shifts or moves? I certainly do not, as I believe them all to be within the reach of man. What is wanted is for man to persevere, and take up Nature's scientific laws at the right end. But be that as it may, I am certain that every practical miner will consider it a favour bestowed on him if Sir R. I. Murchison, Sir C. Lyell, and Mr. W. Smyth will give their candid opinion on it. Mr. W. Smyth's views would be particularly esteemed by me, on account of his actual practice. I may add that undeniable proof is at hand to show that a large proportion of these moves took place before the earth was flooded.

N. Ennor.

### THE SHROPSHIRE COAL FIELD—No. IV.

#### FORMATION AND DENUDATION OF STRATA.

Sir,—The strongest evidence in support of the supposition that the Shropshire and the South Staffordshire fields are but portions of one mineral basin is to be found in certain features presented by the Pennystone ironstone, one of the most important, and, at the same time, one of the most persistent measures in the two fields. We are not sufficiently familiar with other measures of the South Staffordshire coal field to be able to identify them with those of Shropshire, but we are assured by those well acquainted with them that they find little difficulty in correlating them. We can speak more conclusively as to the Pennystone. It occupies nearly the same relative position in the series in the two fields: it occurs in each at about the same distance from the base of the measures, and it presents every appearance of having been formed under the same conditions, and at the same time; in both fields, also, it is accompanied by the sulphur coal, which lies immediately below it. It is exceedingly advantageous to Salopian geologists that, owing to the convulsions which have tilted and rent the Shropshire coal field, there are few measures of the series, and particularly amongst the lower members, but can at one point or another be seen on the surface. Thus, we have the inferior lower coal and ironstone measures cropping out at great angles at Lincoln Hill; whilst in a cutting on the Wellington and Severn junction line, near where the fossil trees were found in the Crawstone rock, the Clod Coal, the Randle Coal, the Best Coal, Two-foot Coal, Sulphur Coal, and Pennystone ironstone are seen. They succeed each other as follows—

| | ft. | in. |
|---|---|---|
| 1.—Sand rock, with pebbles, shales, &c. | 30 | 0 |
| 2.—Lancashire ladies, coal from | 0 | 6 to 9 |
| 3.—Clunch, with sandstone balls | 12 | 4 |
| 4.—Coal smut | 0 | 9 |
| 5.—Rock | 10 | 6 |
| 6.—Crawstone measure crust | 1 | 8 |
| 7.—Crawstone measure | 5 | 0 |
| 8.—Flint coal, flint rock | 20 | 0 |
| 9.—Flint coal | 3 | 2 |
| 10.—Clod upon the flint coal | 1 | 4 |
| 11.—Strong rock | 2 | 0 |
| 12.—Little flint coal, tuff very hard, and full of large ironstone | 13 | 10 |
| 13.—Clod coal, clunch, or poundstone | 2 | 1 |
| 14.—Pricking under clod coal | 0 | 7 |
| 15.—Clod coal, very good | 1 | 10 |
| 16.—Clod between middle and clod coal | 0 | 10 |
| 17.—Middle coal, very indifferent | 2 | 8 |
| 18.—Clod very hard | 2 | 10 |
| 19.—Clod very soft | 1 | 8 |
| 20.—Best coal | 2 | 8 |
| 21.—Clod on the top of the best coal | 0 | 7 |
| 22.—Upper part of the best coal rock | 17 | 0 |
| 23.—Pricking under Main Ganey coal | 0 | 6 |
| 24.—Main Ganey coal | 1 | 3 |
| 25.—Ganey coal stone | 0 | 6 |
| 26.—Lower part of Ganey coal | 6 | 2 |
| 27.—Little Ganey coal | 0 | 6 |
| 28.—Upper part of the Ganey coal | 5 | 2 |
| 29.—Pricking under Two-foot coal | 0 | 8 |
| 30.—Two-foot coal, very indifferent | 1 | 3 |
| 31.—Dark clod upon Two-foot coal | 0 | 9 |
| 32.—Bottom of the Two-foot rock, clunchy | 7 | 0 |
| 33.—Middle part of the rock, very large balls of ironstone line this rock | 10 | 4 |
| 34.—Upper part of the Two-foot rock, clunchy | 2 | 4 |
| 35.—Viger coal | 1 | 3 |
| 36.—Viger coal rock | 10 | 2 |
| 37.—Sulphur coal | 1 | 4 |
| 38.—Clod under Pennystone | 1 | 1 |
| 39.—Pricking under Pennystone | 0 | 5 |
| 40.—Pennystone | 6 | 0 |
| Total | 190 | 0 |

The Pennystone varies very much in quality and in thickness; in some instances, as at a pit sunk near Lilleshall Old Hall, it was found to be upwards of 30 ft. in thickness. The Crawstone of the Madeley Wood field, described in our last, contains upwards of 40 per cent. of iron, whilst the Pennystone, according to the analyses made at the School of Mines, contains 35 per cent. in the north of the field, and nearly 1 per cent. less in the south, as at Madeley. The results tabulated of the Pennystone now worked at the pits of Mr. W. O. Foster, M.P., at Madeley Court, are as follows:—

| | Grains |
|---|---|
| Protoxide of iron | 44·19 |
| Protoxide of manganese | 0·99 |
| Alumina | 0·41 |
| Lime | 1·63 |
| Magnesia | 3·40 |
| Carbonic acid | 32·02 |
| Phosphoric acid | 0·29 |
| Silicia, soluble in hydraulic acid | 0·37 |
| Sulphuric acid | 0·06 |
| Bisulphide of iron | 0·43 |
| Water, hygroscopic | 0·45 |
| Water, in combination | 1·21 |
| Organic matter | 0·42 |
| Ignited insoluble residue | 13·50 |
| Total | 99·47 |

Where well developed, the nodules produce from 2200 to 2600 tons in the acre.

Where so much sediment containing so much iron was derived from, or by what process the material was ground up so fine, is not very clear. From the presence of lead and titanium, the former of which runs sometimes from the tuyeres of the furnace in smelting, and the latter of which forms beautiful crystals in the hearts, it is supposed by some to have been derived from trap or other rocks of a volcanic nature. Against these views, and in the absence of any chemical analyses of the rocks themselves, we feel some hesitation in hazarding an opinion, but we cannot help imagining that this mass of exceedingly fine sediment, spread over so many square miles, was derived from upstanding cliffs of Cambrian or Silurian rocks, branching off, it might be, from the Longmynds. The absence of sand, gravel, or any coarse detritus, and the uniform fineness of the sediment, is remarkable, and suggestive of some bar, either of Lower Silurian or Cambrian rock, which prevented the full rush of tidal waves and currents inland, but which permitted such waves to throw the finer sediment they carried with them into lagoons. Anyone familiar with the shale forming the passage beds from the Llandillo flags to the Caradoc sandstone cannot fail to be struck with the strong resemblance between them. They are of the same degree of fineness and pretty much of the same colour as the Pennystone shale, but more stained with iron and more laminated.

One striking feature of the ironstone is the entire absence of plants, of the roots, or leaves, or, indeed, of any trace of vegetation, if we except certain fragments of wood, usually found rolled up in nodules; these have the appearance of having been water-worn, and convey the idea that after having been the sport of the waves, they became water-logged, sunk to the bottom, and were hermetically enclosed in clay, which preserved them as perfect pieces of wood as they were at the moment they became enclosed. Most of these appear to belong to one of those genera of coniferous plants allied to the Araucarian division of pines, more than to our common European firs, the organic structure being so complete as to offer the best opportunities for studying their structure. We have several beautiful specimens showing the perfect structure of the central pith, similar to those of modern trees, as the common walnut and white jasamine. There are several in the very fine collection presented by the late Mr. J. Anstice to the Coalbrookdale Literary and Scientific Institute; and one, also from Coalbrookdale, in the possession of Prof. Williamson, is figured by Sir C. Lyell, Bart., in his last edition of "Elements of Geology." But, although the flora of the period is so scantily represented, the Pennystone presents us with many very beautiful specimens of the fauna of the period. The nodules of ironstone are often tunnelled by marine worms, who appear to have traversed the fine silt of the Pennystone sea in all directions, swallowing large quantities of it, in order to extract its organic matter, and then returning it comparatively pure. These worm-casts are numerous, often lying at one of the holes of the burrow, in light-coloured threads, similar to those which may be witnessed on our modern coasts, when the tide is down. Similar traces exist of those curious burrowing bivalves, originally considered as a species of Unio, but now classed under the head of Anthrocosia. Rolled up in many of the nodules are to be found the little cone-like conularia. One or two singular species of cronidea, too, are found on the surface of the larger nodules, on which, like Gothic columns in miniature, their slender shafts have been thrown down, thus displaying their beautiful star-like joints. Spirifers, supposed to indicate comparatively deep marine water, are numerous, the singular spiral appendage on the shoulder of the shell being often visible; whilst Producta scabricula—another deep sea-water species—is even more so. A considerable number of marine sauroid fish remains, including those of the Megalicthy-Hybberti; and of those shark-like fishes, the Gyracanthus, Ctenacanthus, and Hybodus occur.

Throughout the entire field where this measure is worked traces of these creatures are found. Break any round stone you meet with, and it is almost certain to turn out to be the sarcophagus of these tyrants. On the borders of the basin where, from the shallowness of the water on what we may imagine would be the southern shore of this lake, or inland sea, it is probable these armed monsters came to sun themselves when gorged, may be found great numbers of round white balls, phosphate of lime—the droppings—containing undigested portions of their food. The number of these coprolites, sometimes in heaps, but everywhere found throughout the field, attests the numercial force of this class of fish, the terror and destroyers of the smaller fry. The remains of the fish themselves are fragmentary, but it is by means of such relics that the character and class of the fish themselves have been made out. The formidable figure of the megalicthys, or great fish, as the name implies, may be studied from its rounded muzzle, the armour-plates that protect the throat, and the mouth bristling with double rows of teeth on the upper and lower sides, and from the hard covering with which the back and sides were encased. Their scales, from the line where one overlapped the other, appear to have been enamelled with a material brilliant as polished steel. Contrasting with the smooth and polished covering of the megalicthys, are the beautifully-corrugated plates of the holoptychus, and the finely-sculptured specimens of other species of the family, some armed with sharp projecting points, and curiously interlocking one with another. Teeth of the megalicthys are found thick as the finger, and as long as the finger from the second joint; and others, which probably belong to the gyracanthus, very much rounded at the ends, whilst some are flattened, and worn down to plates, each presenting a face of whitish enamel, showing thousands of small pores. We have a number of these, one of a large size, swelling out a good deal at the base, and disclosing the corrugated interior of the jaw. The reason assigned for so many of these teeth being found isolated from other portions is that having been attached to a cartilagenous substance in the mouth, and not fixed at all in the jaw, they readily became separated at death and scattered, as we now find them.

The Rosser vein ironstone of South Wales corresponds very closely in its remains with the Pennystone. And Mr. Beete Jukes, in speaking of the Pennystone of South Staffordshire, remarks how closely the animal remains resemble those found in the Pennystone of Shropshire; he says they are, however, "confined to a very small district, between Oldbury and Portway. In one mass of ironstone, lingulæ were mingled with the common shells, called unio, which are so abundant in many of the ironstones; but it appeared that generally, where undoubtedly marine shells were present, these so-called unios were absent." We append a list, which, however, is not a complete one, of the fossils we have found in the Pennystone of the Shropshire coal field, and most of which are now in the Museum in Jermyn-street:—Aviculopecten, of which there are two species; Schizodus Sulcatus, Litorina obscura, Myacites Sulcata, Anthrocosia subconstricta, Anthrocosia robusta, Anthrocosia aquilina, Anthrocosia acuta, Anthrocomya,

and Myacites, several species; very numerous examples of Anthracoptera quadrata, Axinus (formerly Venus), Carbonarius, and Anthracosia sulcatus. Ctenodnota Æqualis, Spirifer bisculatus, Lingula mytiloides, Productus scabriculus, Dicina Nitida, &c., more rarely; Goniatites, Bellerophon, Natica, Pleurotaria, Orthoceras, Nautilus, two or three species, more common; Rhyconella, Conularia, and the remains of at least five genera of fishes. JOHN RANDALL, F.G.S.

## ON BOILER EXPLOSIONS—No. II.

SIR,—It must be recollected that only a few practical ideas, or rather truisms, are proposed to be dealt with in these letters. It will scarcely be denied that the great bulk of boiler explosions are to be attributed to weakness, to old age, defective repairs, &c. Various proposals have been made on these heads—to limit the age of a boiler to 20 years, or some other fanciful term; to test all boilers at certain regular intervals, &c. It certainly does appear strange that such a remarkable and dangerous piece of machinery as a boiler should have no practical limit assigned to its age. A man who ventured to drive or ride a horse (say) 25 to 30 years of age would be considered rather a reckless being. Still it must be confessed that it would be a difficult problem to assign any precise or particular age for all boilers. The testing of boilers appears to be absolutely necessary, and this testing ought to be periodical. The placing of all boilers under inspection appears to be the course likely to prevent explosions, and there cannot be a doubt that a strict and impartial inspection would reduce materially the gross number of explosions, prevent the loss of many lives, and also the loss of much valuable property.

The inspection of boilers in connection with their insurance has, no doubt, worked most admirably, as can be satisfactorily proved by reference to the ascertained results arrived at by the Manchester Boiler Association. A similar institution is much wanted in the North, and its head quarters ought to be either at Durham or Newcastle. The collieries, mills, and factories of this district would afford ample employment for such a society, but as to the universal introduction of inspection in any form it is to be feared that this can only be effected by making it compulsory. The Goverment Inspection of Coal Mines is a vexed question, and the difficulties met with in carrying that out are well known; but the inspection of boilers would be a very simple matter as compared with mines. It is, however, clear that general inspection by the officers of a society would materially benefit the owners of works. A boiler ought not to be patched or mended, like old clothes, but when found defective ought to be thoroughly examined and repaired, and when the plates generally show signs of old age or weakness the boiler ought to be discarded, and a new one put into its place.—*Newcastle, May 6.* M. E.

## NITRO-GLYCERINE AND DYNAMITE.

SIR,—As the above explosive agents are attracting considerable attention, I will, by your permission, give the result of some experiments we have made here with it. Felspar is, I may state, quarried to a considerable extent on this island, Wäddö, and whenever the weather permits, glycerine is always used, and I have seen it used in January, and the weather intensely cold; of course there are certain precautions necessary—as drawing the cork previous to putting the can into warm water. I had seen some trials made with it in Ireland, and, according to the instructions forwarded, a percussion-cap was attached to the fuse. Here in Sweden the miners measure the quantity of oil required into the hole, and then put in a wad of paper on it, and then a small quantity of powder, and insert the fuse in the usual way, and tamp with dried clay or sand. From enquiries, and what I have seen, it gives great satisfaction. There can be no question of its value in quarries or large open surface excavations, but whether it can be used in a close end, or where the ventilation might be defective, I am not prepared to say. Dynamite is, I presume, simply glycerine; and as your correspondent, "H. Y." (Barnstaple), states in the Journal of April 11, is mixed with some woody material, to keep the particles separate from each other. We procured a quantity of it from Nobel's factory in Stockholm; it is made up in oil-papers, and contains about 1½ oz. in each. Some trials we have made with it are satisfactory; although caps were forwarded, we explode it in the same manner as glycerine, by using a small portion of powder. The miners are satisfied in using it, and do not look on it as more dangerous than powder. We have a large lode of sulphur ore here, and now purpose using glycerine and dynamite, to fully determine its value; possibly it may interest some of your readers, and I shall have great pleasure in forwarding the results of our experiments.

*Sulphur Mines, Norrtelje, Sweden, May 1.* W. HOSKIN.

## THE NEW BLASTING AGENTS.

SIR,—The enormous advantages claimed for nitro-glycerine, both pure and in its protected form of "dynamite," as a substitute for gunpowder in blasting operations causes considerable interest to attach to all really reliable statements concerning it. That both pure nitro-glycerine and dynamite possess the power of exploding more violently than gunpowder cannot be denied; but it may fairly be contended that the commercial value of a blasting agent does not depend exclusively upon the suddenness of the explosion. The nature and properties of nitro-glycerine have been so long known to the scientific world, it having been discovered some 20 years ago by Dr. Sobrero, and since carefully studied by De Vrij, Gladstone, Wagner, Kopp, and others, that there should be no difficulty in framing a code of rules to prevent any unnecessary risk in handling it. Nitro-glycerine when pure is a colourless, or slightly yellowish, liquid of the specific gravity of 1·525 to 1·6; it has a sweet, pungent, aromatic taste, but no smell, and is highly poisonous. It has many extraordinary properties; it does *not* take fire, even when touched with a light, nor does it explode by being so touched, yet a red-hot iron, or very moderate concussion, such as that caused by the explosion of gunpowder or fulminates, causes it to explode at once. Taking these facts alone, it has been declared that nitro-glycerine and dynamite can be as safely handled as gunpowder; but, unfortunately, there are other properties which are likely materially to interfere with its general introduction, even presuming that it possesses all the good qualities that have been claimed for it.

Nitro-glycerine in its liquid state is comparatively harmless, more especially if it be chemically pure. According to Dr. J. R. Wagner, the well-known chemist to the Bavarian Government, pure nitro-glycerine may be cooled down to 4° Fahr. without becoming solid, but the nitro-glycerine of commerce solidifies if exposed for a continued period to a temperature even as high as 46·4° Fahr., crystallising in long needles, which are most dangerous to handle, since they explode, even when gently broken, with frightful violence. Now, as the temperature of 46·4° Fahr. is higher than three-fourths of the store-rooms in general, the difficulty of preventing nitro-glycerine assuming the dangerously explosive crystalline condition will be readily appreciated. Nor is the danger in any degree lessened by storing the material in a warmer place, for it is admitted by those most in favour of the new blasting agent that, owing to the extreme instability of the compound, as much danger is to be apprehended from slight additional warmth as from the slight withdrawal of warmth already mentioned. Indeed, the range of safety is only, taking the figures most favourable to nitro-glycerine, 30° Fahr., or a difference of temperature smaller than that between an April night and an April noonday. Whilst 46·4° Fah. is so cold as to make nitro-glycerine dangerous by crystallising it, 74° Fah. is sufficiently hot to affect by warmth (even when pure, and the commercial quality is still more readily affected), for at 74° Fah. nitro-glycerine will usually undergo incipient spontaneous decomposition, accompanied by a slow but sufficiently strong escape of gaseous compounds, which, while exerting a slight pressure on the vessels the liquid is contained in, can also cause the *fluid* to explode on the slightest concussion. At 320° Fah. the nitro-glycerine decomposes rather rapidly, and if the heat be suddenly applied, or slightly raised above this point, the substance explodes instantaneously, and with great violence, shattering open vessels into the smallest fragments.

With regard to "dynamite," or protected nitro-glycerine, there can be no doubt that, as a blasting agent, it can be much more conveniently employed than nitro-glycerine, but as it consists merely of a mechanical mixture of nitro-glycerine and an absorbent granular material, it is difficult to conceive that it can be used with greater safety than the pure nitro-glycerine. There is, of course, less danger from crystallisation, but it would be equally liable to spontaneous decomposition at the temperature mentioned for the unprotected nitro-glycerine, whilst the absorbent—usually sawdust, or its equivalent—would, probably, tend to increase the temperature of the mass to the explosive point more quickly than when it is absent. It must be remembered that the greater the percentage of sawdust, the smaller would be the difference of force, as compared with gunpowder. As to the comparative strength of gunpowder and of nitro-glycerine, that of the latter seems to have been much overstated, for, whilst it is well known that a good gunpowder will, on combustion, yield 450 volumes of gases for each volume of powder consumed, and it is estimated that, owing to the heat generated in the conversion, these 450 volumes are expanded eightfold, giving 3600 volumes of gas in all, it is found that one volume of nitro-glycerine will give 1298 volumes of gases, and multiplying this by 8 for temperature, we get 10,384 volumes in all, consequently nitro-glycerine is *three* times (not 13 times, as has been stated), the strength of good gunpowder.

But for blasting purposes it is very doubtful whether, although three times the strength, nitro-glycerine is preferable to gunpowder, for the action of the two substances is widely different. All miners know the difference of effect produced by a quick and by a slow powder, and quick powders do not, as a rule (for in certain kinds of ground the rule does not apply), give such good results as slower powders. Now, nitro-glycerine, alone and as dynamite, is very quick, and produces a shattering rather than a rending explosion, so that comparing the work done by each blast there may be an apparent advantage for nitro-glycerine, although taking a certain number of fathoms driving powder would have the best of it. The difference between nitro-glycerine and blasting-powder for mining purposes is much the same as between detonating powders and gunpowder in guns. It is found in the latter case that when the powder evolves its gases too rapidly its force is exerted against the side of the gun, or, in other words, all in one spot, instead of being so distributed as to produce the maximum effect in propelling the ball. It is the same with nitro-glycerine—it exerts great force, but, as the force is not distributed, the effect produced is very small. The only kind of ground in which nitro-glycerine is useful is where there is a good cleavage, as in slate quarries, the reason being obvious; if the hole be put in judiciously the nitro-glycerine will shift as much as the toughness of the rock will hold together, and as the force is all expended on one spot, the slate will not be injured to the same extent as it would be were there no cleavage; but even in slate quarries the relative value of the two blasting agents will depend upon the nature of the rock, because if the slate be at all inclined to be tender the quantity thrown down by the nitro-glycerine will be no greater than with powder, whilst its shattered condition will be such as to render it almost worthless. But in all cases powder is to be preferred, because as its gases are much less rapidly evolved they have time to follow the cleavage as the rock opens, and thus produce the largest quantity of useful work with the smallest possible force.—*April 28.* NITRE.

## LEAD SMELTING.

SIR,—I noticed a letter in the Journal of April 25 signed "Observer," in which the writer professes to relate the result of a visit made to Leadhills. He seems to have been greatly disappointed by the appearance of Mr. Forster's ore hearth, evidently expecting some very large and costly furnace, instead of which he found, what indeed I distinctly stated it was in my letters on the subject, in appearance an ordinary Scotch ore hearth, but altered in construction. I will leave it to those who are conversant with smelting whether any other form could be more desirable, seeing that the Scotch hearth is simple, inexpensive, and has always been extensively used for smelting ores. As to his statistics, I think he cannot have witnessed its working, as I can vouch for the accuracy of my statements regarding it at that time, and I believe it is still working as well as the inventor could wish. "Observer" states that he has found out the peculiarity of its construction, and that it has already been tried in the North of England. I may inform him that Mr. Forster was engaged in the North of England for 43 years, chiefly at Mr. Beaumont's works, and, therefore, is practically conversant with all the different systems of smelting pursued in that locality, and he is confident that his plan has never yet been tried; and this, from my own acquaintance with the subject, I quite believe. "Observer" also estimates the weight of the stones of a Scotch ore hearth at 50 cwts., whilst 25 cwts. would be nearer the mark. As to his advice to "F. W. P.," I need scarcely add that any gentleman calling on the manager has, I believe, never been refused permission to inspect anything connected with the mines, and that, therefore, there is nothing of good luck connected with such an easily obtained privilege. I am sure that Mr. Forster will be happy to show him the hearth, when he will be able to judge with his own eyes as to its capabilities. "Observer" goes out of his way to sneer at the state of the works, and, I can assure your readers, with little truth on his side. I have heard many competent authorities acknowledge that the smelting-mills at Leadhills are the most complete, commodious, and best arranged works of the kind they have ever seen, so far as they are yet constructed. I believe that very shortly apparatus for desilverising the lead will be erected, when I think I could challenge "Observer" to name any other mill equal to it in its arrangements; and let me, in conclusion, advise "F. W. P." not to look for Leadhills in Dumfriesshire, as it is in the county of Lanark. MINING ENGINEER.

## PREPARATION OF MAGNESIA EMPLOYED AS A REFRACTORY MATERIAL.

SIR,—Two years ago M. H. Caron pointed out the advantages obtained in metallurgical operations by the employment of magnesia as a refractory material, but the high price of this earth at that time seemed to conclude that it would remain only for use in laboratories. Now, the circumstances are happily changed; the recent improvements introduced into the manufacture of cast-steel, especially by the adoption of Siemens's furnaces and the Martin process, require imperatively the employment of bricks more refractory than those commonly in use, whatever be the cost. On the other hand, the carbonate of magnesia, which used to cost 10*l.* a ton, can now be had for 2*l.* 16*s.* delivered at Marseilles, or 4*l.* delivered at Dunkirk. The calcination on the spot of the carbonate before expedition can further lower the price; this first calcination requiring less heat than that of lime, and causing a reduction of the weight to one-half.

The magnesia hitherto used by M. Caron has been procured from the island of Eubea, where it is found in considerable quantities in the shape of very compact white carbonate, of very great hardness. This carbonate contains traces of lime, silica, and iron; sometimes it is, however, traversed by serpentineus substances and large plates of silex, which would diminish the infusibility of the magnesia, and render it unfit for use, especially for the oxhydric light, if they were not removed. These bands are easily recognised, and can easily be separated, even in the gross treatment. With regard to refractory bricks, the presence of a small quantity of these foreign matters can only give rise, at the very highest temperatures, to a slight vitrification, attended with no serious inconvenience. Before grinding the carbonate, it is advisable to roast it at the necessary temperature sufficient for the expulsion of the carbonic acid; the material then becomes very friable, and can be easily pulverised. It is possible then to separate the serpentine and the silex, which do not disintegrate by heat. This first treatment does not as yet permit the magnesia to agglomerate; and even supposing this difficulty were overcome, a higher temperature than that of the first calcination would give rise to an enormous contraction, producing cracks and deformations, which would render this substance useless. It is then indispensable before moulding the magnesia to submit it to a very intense fire, at least equal to that which it will be subsequently called upon to resist.

Thus calcined, it is in no way plastic, its aspect is sandy, and it obtains no cohesion by compression. A mixture of magnesia less calcined will give it this property; the quantity of this last necessarily varies with the degree of calcination of the two magnesias; it is about a sixth by weight of that which has borne the highest temperature (fusion of steel). Nothing remains now to be done but to wet it with 10 or 15 per cent. of its weight of common water, then to compress it strongly in cast-iron moulds, as is done for agglomerated coal fuel. The brick thus produced hardens on drying in the air, and becomes still harder when made red hot. The same process would seem to be available, by varying the form of the moulds, for obtaining crucibles of large capacity, but the compression is difficult to apply to large masses, and also in the case where the moulds have large surfaces, because the magnesia adheres strongly to the sides. Though he has been able to obtain small laboratory crucibles, M. Caron does not regard this method as applicable to large crucibles serving for the fusion of steel. It is preferable in this case, and also in many others, to agglomerate the magnesia without compression. In order to give to the magnesia a sort of plasticity, M. Caron makes use of a property of this earth, pointed out by Berzelius—that when highly calcined and then wetted it hardens spontaneously in drying. This fact is, undoubtedly, due to a hydration, which is, however, not accompanied by any sensible increase of temperature. The magnesia solidified in this manner only parts with the imbibed water at a very high temperature; at that point, however, the calcination not only causes no disintegration, but, on the contrary, gives a hardness and a resistance comparable to those of ordinary crucibles after being baked. This being well ascertained, we can easily understand how to make use of this substance. Thus, the calcined magnesia for the fabrication of crucibles should be only wetted, heaped in the mould, dried, and then baked. For the lining of furnaces for melting steel there is laid, in the same way, on the sides a paste of humid magnesia; it will harden, and be baked naturally without any particular precautions being necessary. It sometimes happens that the magnesia has been used too wet or too dry, or that it contains siliceous matters, thus causing the crucibles, before or after the baking, not to present all the solidity desirable. In this case, in order to acquire it, they should be simply steeped in water, saturated while cold with boracic acid, dried, and then burned as before. This operation does not render the magnesia less infusible; it only makes the particles adhere more strongly together. Very pure magnesia, strongly calcined and finely pulverised, can be also employed in the state of "Barbotine," and furnish the most delicate and transparent crucibles, even of the most complicated pattern. At some future period this earth may be advantageously employed in the ceramic art, in spite of the difficulty of moulding compared with that of porcelain clay. M. Caron's process is also peculiarly adapted to the magnesia pencils and cylinders of the Drummond and Carlevari's lights. C. H. DOWLING.

*Paris, May 1.*

## IMPROVEMENT OF IRON AND PUDDLED STEEL BY AN ALLOY WITH WOLFRAM.

SIR,—We beg to hand you annexed a report, treating on this subject, for insertion in the *Mining Journal*. This wolfram comes from Germany, and the agents of the German firm in Paris, New York, &c., ever since 1863, when this article was first introduced into commerce, have had a continually increasing sale, chiefly amongst the steel-making establishments. We have laid the matter before some firms in this country, and the reply was that they had heard about wolfram, that it was an improver of iron, &c., to some extent, but that its effects were peculiar and limited, and required a treatment such as could not be given it by British workmen. We are much surprised that this mineral should not have been more generally tried, when abroad its use is extending, and such results obtained that at the works of Cockerill and Co., Belgium, 2 to 2½ tons are used per month. Perhaps, bringing the matter under public notice, may induce some trials,—or replies from your correspondents, explaining how it is that abroad this mineral should be used with advantage, and its high price paid, and not in this country.

A. KEIFFENHEIM AND CO.

*Exchange-buildings, Newcastle-upon-Tyne, May 6.*

## IMPROVEMENT OF STEEL AND IRON BY ALLOYING WITH WOLFRAM.

### I.—IMPROVEMENT IN PUDDLED STEEL AND PUDDLED IRON BY A WOLFRAM ALLOY.

Puddled steel, as generally manufactured, does not, doubtless, possess the good properties of cast-steel; nevertheless, it is becoming more and more extensively used, in consequence of its comparative cheapness. It is employed more particularly in the manufacture of locomotive and wagon tyres, which, however, are much inferior to cast-steel ones, the latter being four or five times more durable than the former, and consequently cheaper in the end, notwithstanding their actual higher price. Ordinary puddled steel is also less adapted to the manufacture of files, saws, weapons of war, edge-tools, thin plates, &c., as it lacks the homogeneous qualities of cast-steel, and consequently the tenacity, hardness, and ductility of the latter. By employing a wolfram alloy the homogeneousness and hardness of cast-steel are imparted to puddled steel, its grain becomes clear and fine, and it is not distinguishable from cast-steel either in the grain when broken, or in the appearance when worked up. It combines an extraordinary tenacity with the greatest possible degree of hardness, and this latter quality can be so much increased by a proportionate use of the wolfram alloy as to far exceed cast-steel in that respect. At the same time, the wolfram puddled steel is malleable (ductile), and easily welded. Wolfram puddled steel is adapted to the manufacture of all those articles for which it has been hitherto necessary to employ cast-steel. The quantity of wolfram alloy varies from 1 to 7½ per cent., according to the nature and object of the manufactured steel articles. Even with a small proportion of alloy a perfect homogeneousness, and consequently great tenacity and strength, will be obtained, whilst by an alloy of more than 3½ per cent. only the hardness will be increased.

For wheel-tyres an alloy of 2½ to 3 per cent. has been found to answer best. Puddled-steel tyres made with the above degree of alloy have been used on the Eastern Railway of France, and have been found even as serviceable as the cast-steel ones. For the manufacturing of axles, and of any other article requiring great tenacity and strength, a wolfram alloy of ½ to 1½ per cent. will suffice, according to the nature of the raw iron employed—that is to say, in proportion as it contains more or less contaminating components of arsenic, sulphur, and phosphorus. For making files, saws, &c., it will be sufficient to have a wolfram alloy of 2½ to 4 per cent., while for mint dies (punches), borers, edge tools, and other objects requiring great hardness, the alloy varies from 4 to 7½ per cent. The influence of wolfram on iron and steel is based on a fact which has been clearly demonstrated by chemical analysis—that it completely neutralises the baneful influence of any sulphur, phosphorus, or arsenic, which may be contained in the raw iron, because it forms a chemical amalgamation with those ingredients. For all practical purposes wolfram ore may be as successfully employed as the wolfram alloy that is made or reduced from it—in fact, wolfram ore is preferable in the majority of cases, inasmuch as, with the like favourable results, it enables us to dispense with the reduction of the ore, and, consequently, diminishes the expenses. In the improvement of cast-iron, also, by means of a wolfram alloy the ore acts more effectively than the reduced wolfram, because the ore in the liquid iron mass must be melted before effecting a chemical fusion with the iron; and as this reduction takes place by the destruction of the carbon in the iron, the latter partakes thereby more or less of the nature of steel. For the production of wolfram puddled steel it is not necessary to erect special works, or to engage special workmen. The pulverised wolfram ore is weighed off for each raw iron charge in a quantity corresponding with the intrinsic percentage which it is thought desirable to allow. This done, it is then mixed with 1 lb. of pulverised manganese and ½ lb. of kitchen salt, and the mixture is put in four to six separate paper packages or bags. After the raw iron charge is smelted in the puddling-furnace, and after a strong heat begins to develope and ascend, the paper bags containing the alloy are to be pressed, one after the other, and at short intervals, into the liquid mass, and at the same time the puddler must quickly stir up the whole with the raker, in order that the alloy may be equally distributed throughout. Before the alloy is thus thrown in the draught-bar or slide of the furnace must be closed, and it must not be reopened until the entire alloy is distributed throughout the iron mass. Then the fire must be well stirred up, in order to facilitate the amalgamation of the wolfram with the iron, and that process is greatly expedited by the manganese already spoken of, because, besides its chemical influence, it also brings about a mechanical action of the iron. As soon as the liquid mass begins again to bubble up and rise,

the puddling process properly takes place, according to ordinary methods, as applicable to local circumstances.

The refined wolfram puddled steel (in French, *acier wolframe corroyé*) must not, when worked up for weapons of war and edge tools, be heated to a greater degree, and must be treated exactly like cast-steel. If it be desirable to give these products a silvery-white and fine grain, they must finally (and whilst in a ruddy white heat) be placed under a light, quickly-worked hammer, and that operation is to be continued until they have lost all appearance of white and ruddy heat. In order that they may *cool slowly* they should be covered with coal ashes. The wolfram puddled iron is made in the same way as wolfram puddled steel; but the wolfram alloy should never exceed 2½ per cent., as a greater amount would cause a prejudicial degree of hardness when the material comes to be worked up. As previously stated, in more precise terms, the baneful influence of whatever arsenic, sulphur, or phosphorus may be contained in the raw iron is neutralised by the wolfram alloy. While, therefore, such kinds of iron as are rendered impure by those components have not up to the present time been servicable for wire sheet-plate, or other articles requiring a strong sinewy iron, those kinds would by employing the wolfram alloy be rendered perfectly adapted to such purposes, and they would furnish a wrought-iron with a long-threaded, sinewy grain, which iron, by its ductility, facility for welding, durability, and relative strength, would equal the wrought-iron manufactured out of the best kinds of raw iron. In proportion to the quantity of impure substances existing in the raw iron, and according to the purposes for which the manufactured objects are intended, the wolfram alloy will vary from ½ to 2½ per cent. More especially will that alloy be found recommendable for the manufacture of armour-plates for ships, as it imparts so much tenacity and strength to the iron, and the like observation applies to ordnance.

II.—IMPROVEMENT OF CAST-IRON BY WOLFRAM ALLOY.

It will be seen from the proofs adduced of the beneficial effects of wolfram on raw iron that the former may be also turned to good account with regard to certain kinds of cast-iron productions. The wolfram ore may be mixed with the cast-iron in two ways—the iron may be smelted in a crucible, and the wolfram ore be then added, or the wolfram dose may be added to the smelted iron in a puddling-furnace, not a cupola furnace. The former method is only to be employed when the raw iron is smelted in the crucible for the purpose of making small cast-iron wares, such as screws, &c., while the latter is the proper one for larger articles. The mode of proceeding will be as follows:—The pulverised wolfram ore will be enclosed in paper bags, in proportions of 4 to 5 lbs., together with the manganese and ordinary salt, the manganese to be 20 per cent. of the weight of the wolfram ore, and the salt 10 per cent. After the raw iron, destined for casting ordnance, cannon balls, rollers, machine axles, &c., is smelted in the puddling-furnace, the above wolfram alloy will be thrown gradually into the fluid mass, through an aperture in the furnace door, and be stirred up and distributed throughout by means of an iron bar. During this operation the draft must be excluded by closing the furnace. Then the fire must be well stirred up, and the iron mass be kept during half an hour in a state of strong fusion. At first the wolfram ore is reduced at the cost of the carbonic ingredients of the iron, when the chemical working of the wolfram begins. To produce raw iron of great firmness it will be requisite to employ a wolfram alloy of ½ to 1½ per cent., according to the chemical composition of the former. This alloy is recommended for the manufacture of pieces of ordnance, cannon balls, axles, and other portions of machinery, as well as for propelling screws and fine cast-iron wares, such as screws, small cog-wheels for spinning machinery, and all sorts of tempered articles. When employed in the manufacture of rollers, which should be very strong and retain a very hard surface, the wolfram alloy should be increased up to 5 per cent.

## THE DARIEN CANAL—No. XIX.

SIR,—Beside the certain revenue that the company will derive from the tolls on the Canal, the towing of ships, the sale and rents of the lands at either terminus and along its banks, the sale of timber, the collection of caoutchouc, vegetable ivory, &c., it is within the bounds of probality that, owing to the existence of both coal and gold in the Cordillera which traverses Darien, the necessary cuttings may bring to light extensive beds of coal and deposits of gold, and thus develope an additional source of revenue. Although coal has not yet been found in Darien, that circumstance is not to be wondered at, considering how little is known of the country; but its existence both to the east and the west of Darien is beyond doubt. In 1851 I saw some specimens of coal at Lorica, on the Sinu, which had been obtained at Cienaga de Oro, higher up that river, which is the next large one to the eastward of the Atrato. On the banks of the Carare, a branch of the Magdalena, coal has also been found; and on my passage to Honda, April, 1852, I met a gentleman who was on his way to Velez, to hire labourers to work in a mine there. Coal has also been found on the banks of the Magdalena itself, near Conejo, about 12 miles below Honda. Coal of excellent quality is obtained at the edge of the plain of Bogota, in the mountain between the village of Soachi and the great fall of Tequendama, which is 12 miles S.W. of Bogota. It is used in Mr. Wilson's ironworks, at Pacho, near the saltworks of Cipaquira. Between Facatativa and Villefa, on the road across the Andes from Honda to Bogota, there is also an extensive coal district. To the westward of Darien and Panama coal has been found on both coasts of Chiriqui, and Mr. Salomons, Mr. Wheelwright, and Sir Edward Parry ascertained that the coal region traverses Chiriqui from north to south. Of the coal field in the south of the Chiriqui Isthmus, Mr. W. W. Ridley, C.E., of New York, says—"Concerning the quantity of coal that can be obtained in Chiriqui, no doubt can be entertained that it is sufficient to supply the steamers on the Pacific for ages." Messrs. Whiting and Shuman, in their report, dated April 1, 1851, on the coal formation of the Island of Muerto, near David, in Chiriqui, say—"We have found the Muerto coal to burn equally as free as the very best English coal, emitting a bright, beautiful flame, with as much bitumen." Dr. Lagarde, the surgeon of the frigate Obligado, which was sent to survey the Pacific coast of Veraguas, brought specimens of the Muerto coal to Professor Rogers, of Pennsylvania, who on analysis found it to contain bitumen, 36·27; solid carbon, 58·48; ashes, 5·25. Dr. Lagarde's report will be found in Capt. De Rosencoat's "Reconnaissance Hydrographique de Veraguas," published by Dupont, Paris, 1857. At the Island of Muerto, Messrs. Whiting and Shuman also found monuments and columns covered with hieroglyphics, similar to those discovered in Yucatan by Stephens. At San Augustin and in the forests of Laboyos and Timaná, about 2° N., near the sources of the Magdalena, there are also columns, idols, altars, images of the sun, and other evidences of the former existence there of a great nation now extinct.

The existence of coal on the Atlantic side of Chiriqui is quite as well established. In 1844 the French Government having built 14 steamers, with a view to establish a transatlantic line, a vessel of war, the brig Papillon, was sent to the safe and very capacious lagoon of Bocas del Toro, commonly called Chiriqui Lagoon, to ascertain the existence of coal in its vicinity. The Papillon had orders to proceed to Chagres at the termination of this mission, and remain there for the convenience of the French Expedition, then engaged in surveying the Isthmus of Panama, for the purpose of determining the practicability of a ship canal across it. On hearing the report of the commander of the brig, M. Napoleon Garella, the chief of the survey proceeded to examine those coal mines, which were said to be of immense extent, and, accompanied by M. Alphonse Morel, agent on the Isthmus of the French Government, and the company to which a privilege for the opening of a canal had been granted by the New Granada Government, verified the existence of coal in the neighbourhood of Bocas del Toro, the samples of which, although taken from the surface of the ground only, proved of a very superior quality. Although the report sent by M. Garella to M. Guizot, the Minister for Foreign Affairs, was highly encouraging, yet, as the line of transatlantic steamers was not established, those coal mines were entirely neglected from that time until 1851. In that year M. Morel, accompanied by M. E. Segret, an engineer who had been engaged in coal mining in France, proceeded to the district, and, after a careful survey of the valleys of the Changuinola and the Xixaola, applied for and obtained at David, the capital of the province of Chiriqui, grants of the four following mines:—1. A vein of coals in Siegi Creek, on the left side of the Changuinola river, 12 miles from Siegi, an Indian village of the Teribe tribe, on the Changuinola.—2. Three veins in the same creek, 6 miles from Siegi.—3. Another in Chauria Creek, 2 miles from Siegi.—4. Another on the creek called Ginia and Pochigru, half-way between Siegi and Ginia, and about 12 miles above the mouth of the Changuinola. They found other veins 2 ft. broad, and surrounded by schistose rock, in Fugigo Creek, near the River Branche, 3 miles below Ginia; these run in the mountain side, and are about 6 miles N.E. of the Ginia veins. Numerous veins were also found in the valley of the Xixaola, which opens into the Atlantic 6 miles N.W. of the Changuinola. These veins are chiefly on the banks of the Mone Creek, which is near Cerro Negro Mountain. The country is well peopled by friendly Indians, who are willing to work for a small remuneration. The Indian tribes of Bocas del Toro have no relations with the New Granadians, and are quite independent, but they are friendly to foreigners, and always ready to work under the direction of the white man. There are three tribes in the district—the Teribe Indians, living in the valley of the Branche river; the Changuini, in the Changuinola Valley; and the white Indians, so called from the lightness of their colour, who are the most numerous, laborious, and friendly. The women of those tribes work as much as the men, and when M. Morel began to extract coal they set to work at once to help him. The wages are paid in goods. Besides the independent Indians, there are two villages of civilised Indians, citizens of New Granada, governed by two Spanish missionaries. These people are very industrious, and work for $6 a month.

The same district was more recently examined by the United States Expedition, sent in August, 1860, to survey the lands of the Chiriqui Improvement Company, who proposed to make either a railroad or a gravel road across the Chiriqui Isthmus, from Frenchman's or Grindstone Creek, in Chiriqui Lagoon, to Golfito, midway between the entrance and the bottom of the Gulf of Dulce, on the Pacific. Golfeto has an outer and an inner harbour, with good depth of water and ample space, and is completely sheltered. At each terminus every natural facility exists for a dockyard. Dr. Evans, the geologist of the expedition, found a coal field extending from Secretary and Saddle Hills, at Cape Valleàte, for 50 miles in a N.W. direction, through Popa Island to the Changuinola. The breadth of the coal field varies from 5 to 14 miles, and the aggregate thickness of the seams is 74 feet. The coal is described as well suited for steam navigation and all ordinary uses, especially so at Sierschik (Siegi?) and Jinia Creeks, tributaries of the Changuinola, where the thickness of the eight seams is 30 feet. Great variety of timber suitable for shipbuilding is found on the islands in Chiriqui Lagoon and on the mainland, as Santa Maria, cedar, dogwood, sumwood, &c., of which planks from 80 to 120 feet may be cut. Dr. Evans deposited specimens of the woods, coal, and other minerals in the Smithsonian Institute at Philadelphia. Capt. Engle, U.S.N., chief of the expedition, makes very honourable mention of the accuracy of Captain Barnett's survey of Chiriqui Lagoon.

Some years ago a discovery was made at the village of Tarraba, in Costa Rica, immediately west of Chiriqui, of a bed of coal upwards of 6 miles in length and 150 feet in breadth, as certified by an official report to the President of the Republic, and by a letter of Senor A. Ximenez, a merchant of San José, who says—"There is not only one mine but many, and all of excellent quality, for I have seen specimens of them at the house of the President; some of them appeared to me to be very superior." Thus, there is coal both to the eastward and westward of Darien, and it is not unlikely that future investigations may lead to the discovery of coal in Darien itself. The existence of coal in Veraguas, Chiriqui, Costa Rica, Vancouver Island, the Aleoutian Archipelago, Amoy, and the Island of Formosa is a great point in favour of the route from Panama to China by grand circle sailing. In 1835 Dr. Coulter, an M.D. of Trinity College, and a good mineralogist, who brought the Real del Monte Mine into notice, whilst at Chatham Island, one of the Salapagos, that he visited in a whaler, of which he was surgeon, reported that he found in his rambles in the interior immense quantities of excellent coal. The accuracy of this statement is worth enquiring into, as the existence of coal there would be of great advantage to steamers running between Panama and Australia. E. CULLEN.

*Dublin, May 6.*

## MINERAL RESOURCES OF LA PLATA STATES.

SIR,—The last news, either by telegram *via* Lisbon, by the Brazilian mail, or the more reliable communications from Paris, furnishes conclusive proof of the utter incapacity of the allies to complete their invasion of Paraguay, and to accomplish any of their objects by force. So far the undertaking has been ruinous and destructive to themselves. Mediation through a friendly power can alone bring the sanguinary struggle to a speedy termination, unless, indeed, Brazil is able to borrow no more money in London, for unless that can be obtained in this country it will be obtained nowhere else, and without a loan neither Brazil nor Buenos Ayres will be able to sustain more than the present campaign, already so unfortunate for both. As to Uruguay, the late revolution will probably separate her from the alliance. As it is certain that the war must soon terminate, either by the exhaustion of the invaders or by mediation, it is important to consider the commercial prospects of those fine regions, and especially in the department in which the readers of the *Mining Journal* are most interested. The capital embarked by Englishmen in the Banda Oriental, the Argentine Confederation, and on the shores of the Paraguay is great, amounting to not less than 75 millions sterling, and at present all this property is in peril, through the ambition of a single city of La Plata—Buenos Ayres, and of the Government of St. Christobel. If peace were established these 75 millions sterling of British capital would be productive, and scope would be given for the employment of ten times that much through a few decades of commercial, manufacturing, agricultural, and mining progress. It is of importance to the English miner and capitalist to have correct information as to the resources of so extensive and beautiful a region.

Leaving out of consideration the vast empire of Brazil, which is better known than any other of the Atlantic States of South America, and which would require a separate letter to do any justice to its mineral resources, there remain the three La Plata States—Uruguay or the Banda Oriental, the Argentine Confederation, and Paraguay. In the Oriental State there is abundance of mineral wealth, which will never be brought forth, unless capital and skill are employed by citizens of the United States, or of England. It will be also necessary for the State to receive immigrants from Europe, and especially from the British Isles. The hardy miners of Cornwall, Devon, the Black Country, Wales, and Scotland, might be employed in Uruguay alone, and thus a vent be found for the unemployed labour of many now depending in the United Kingdom upon the poor-rates. The mineral produce of "the Oriental" is as varied as vast. Gold is obtained in the sands of rivers and in the rock, and nuggets have occasionally been found. Copper is in sufficient abundance to influence the trade of South America in that article. Hitherto the Pacific States have been most prolific in that metal, but there can be no doubt that the Atlantic States are also rich in copper in various forms. Lead is to be found in various parts of the Banda Oriental, and generally yielding a considerable proportion of silver, varying from 40 to 100 ozs. to the ton. There are a few portions of the country where silver exists in its purest form. Uruguay is, however, happily for herself, richer in the inferior than in the superior metals. Coal is plentiful, both anthracite and bituminous. No oil-wells have as yet been discovered; but where anthracite lies in extensive beds, petroleum will, probably, be eventually discovered. It would be of great consequence to the commerce of the Plate River if Monte Video held a large store of coals for shipping purposes, which would be the case were the resources of the interior, and facile communications opened up. Freights would then be lower, and commerce on the river and its confluents, as well as the ocean traffic, would be greatly promoted. As coal-bearing countries have iron, so the Banda Oriental has this great element of civilisation also. The coal and iron are nearly contiguous, and thus facilities as well as resources for future manufacturing powers are provided. There has not yet been a sufficient exploration of the country to bring to light the many valuable minerals not classed with metals. A very superior flint is abundant, which is unrivalled, when ground, for optical purposes. Precious stones have not been discovered in any great abundance, except agate, which is obtained in the rivers. Ajax also rewards the enterprising searcher.

The Argentine Confederation is one of the most magnificent ranges of territory in either hemisphere. The area of the Republic is not less than 57,000 square leagues, and vast territories stretch away in every direction, sparsely populated, and in many places showing geological evidence of mineral wealth. The Chaco, Pampa Argentine, and Patagonia include an area of 69,000 square leagues, with scarcely more than a single human being to the league. Metals and minerals are abundant in the Argentine Confederation; but although since the discovery of the vast silver deposits of Potossi this has been well known, so miserably deficient in persistent energy and working enterprise is the Spanish race, that but little of the buried wealth of this rich republic has been turned to account. The Confederation consists of 14 States or Provinces, as they may be called. Of all these, Buenos Ayres is the best known, and the most thickly populated; for while in the whole Confederation there are but 25 inhabitants to the square league, there is in this province more than 2¼ that number. The city of Buenos Ayres is the great commercial capital, although no longer the political capital. Yet this thriving business city has always been aggressive to neighbouring States, and arrogant and rebellious toward the Confederation from which she has endeavoured repeatedly to separate. Her hope is the same as the Brazilian Emperor—to dominate the Plate River and its navigable tributaries. This is against the enterprise of foreigners who have settled there. The English select Buenos Ayres, as the Italians almost invariably prefer Monte Video. The province of Buenos Ayres is as flat as it is fertile, and naked of timber. Gold and silver are found in every province of the Argentine Confederation but Buenos Ayres, Santa Fe, and Entre Rios. Throughout the whole Republic the following metals are generally distributed:—Tin, zinc, nickel, antimony, mercury, lead, and iron. Besides, there are the following important minerals in almost every province of the Confederated States:—Bitumen, lime, coal, salt, petroleum, clay for bricks, and marble. There are, besides, very many kinds of precious stones, which are found in considerable numbers.

The British miner investing money and enterprise in a country so metalliferous and mineral would not be at a loss for sustenance. He would not have to labour amidst an unproductive soil for the products of the rocks which, although barren above, are often so rich within. The wonderful variety of geological and mineralogical peculiarities causes, also, a singular diversity, almost a universality, of produce, such as cereals (wheat, barley, oats, rye, maize), apples, pears, grapes, figs, peaches, oranges, lemons, pine apples, sugar, coffee, tobacco, potatoes, mustard, meat, cheese, preserves. Cotton is also produced, silk and hides in great abundance, tallow, and olive and other oils. Almost everything man can want is yielded in this fertile confederation of States. In some foreign countries the miner, if not in danger of falling short of food, can only purchase any manufactured articles at an enormous price, and cannot procure many such at all. English capital and intelligence have already established many manufactures in the Confederation. Tallow, soap, sugar, cigars, silk, cutlery, saddlery and harness work, wines, flour, and a great variety of preserves are made in the country and exported, while Buenos Ayres is an open gate through which the products of England may teem. Paraguay is the remotest of these States, and is now waging a holy war against the alliance of the other States, an alliance, however, which is of their Governments rather than their peoples, the Brazilians and the citizens of Buenos Ayres alone entering heartily into the struggle.

The territory is much smaller than either of those just described, but the country is picturesque and prolific. The miner there would be able to procure everything necessary to his avocations, and a perfect luxury of fruits, vegetables, meat, cereals, and the delicious Herba—the tea of Paraguay. I believe there is no published account of the mineral productions of this beautiful country; your readers will, therefore, peruse with the more interest this brief notice. The mineral districts are Caapucu, Hicuy, Olimpo, and Guaira. The first-named is enriched by iron and quicksilver; it is in the central portion of the country. Hicuy is also central, and bears the same minerals. Olimpo y Pan de Azucar is on the Upper Paraguay, and possesses vast quantities of saltpetre. Guaira is on the Upper Parana; it abounds in copper in every form in which it is procured, and has vast coal fields of both qualities. Agates and other precious stones are found in the region of the Upper Parana. The iron fields are vast, and constitute the most precious treasure of the country, for no Swedish iron makes better steel. There is coal of the quality, and so situated, as to be available for working the iron. Such, Mr. Editor, are the features of those great countries which only require peace to be prosperous, and to contribute to the prosperity of remote nations, especially England. If Paraguay wins the day, and keeps her independence, it will not be in the power, as it is in the purpose, of Brazil to close the waters of La Plata, so far as a free commerce is concerned. CITIZEN.

## MINING IN MEXICO.

SIR,—The history of Mexico, from the moment when Cortez—a Spanish adventurer—bound its sovereign in chains, and degraded him in the eyes of his subjects, reflects no honour upon civilisation. How Spain treated this dependency, with its vast riches and resources, is only too well known. The annals of the emancipated colony, from the day on which it threw off the dominion of its European rulers, present one uniform tale of turbulence, anarchy, and bloodshed. The independence of Mexico was recognised by the principal powers of Europe in the year 1821; but the existence of the Government as a Federal Republic was of short duration, and, from that period to the reconstruction of the Empire under the sovereignty of Maximilian, the country passed through no less than 36 revolutions, and 72 different personages have successively held the chief executive office in the State. The unhappy fate of the last Emperor has again sunk Mexico into deeper trouble, anarchy, and confusion. The violation of every professed principle of honour and consistency under the *regime* of Juarez, in 1860, forbids the hope of progress by his instrumentality, and engenders distrust both at home and abroad in the loudly-proclaimed professions of that notorious chief, about "The Constitution," "Reform," "Liberty of the Press," and so forth. Anarchy is again the chronic disease of the State, and it is impossible to foresee the day when the deplorable condition of the country will become amended. From the era of the conquest by Cortez the population steadily diminished. The future prosperity of Mexico must depend upon the reversal of this depopulating process, which has converted some of the finest districts into a wilderness. Few countries offer greater attractions to European emigrants. The climate, soil, and boundless mineral resources are all calculated to invite settlers. Situated half-way between the east and the west, and forming, as it were, a bridge over which the commerce of two vast continents will probably hereafter be conveyed, with an Atlantic seaboard of upwards of 1200 miles, and the Pacific washing 900 miles of its western coast, Mexico ought to become one of the most flourishing countries of the American continent. The United States were indebted for their marvellous progress and prosperity chiefly to immigration. It is a part of the American policy which Mexico will do well to imitate. China might supply an unlimited number of sturdy and industrious labourers, who would find in Mexico a much more favourable reception and better treatment than they have met with from the Anglo-Saxon race either in California or Australia; whilst Germany could send emigrants who would probably prefer Mexico to any other portion of the world, should the country afford protection, under a sound administration, to both life and property; and probably the German working classes combine more industry and intelligence than any other nation.

Mexico is wondrously productive of the life-sustaining elements of both man and beast, though its agricultural capacity is comparatively undeveloped, only about one-eighth portion of its land being under cultivation. Its population is scanty, and the people are inert and indifferent as to the future, to a degree incomprehensible to the hardy, ready, and industrious citizens of Europe. This wonderful field for agricultural and mineral industry will never attain its natural standard of power and wealth unless the natives become renovated, enriched, and enlightened, through the encouragement of emigration from the more hardy and sustaining surplus labourers of the colder climates.

The mineral produce of Mexico is remarkable, even when compared with that of the richest countries in the world. The annual silver coinage is about $20,000,000 (or say 4,000,000*l.* sterling), and the silver smuggled out of the country is estimated at $7,000,000 (about 1,400,000*l.*) in addition. A large portion of these amounts finds its way to England, and enables her to meet the demand for India and other quarters. Humboldt asserted that two-thirds of all the silver circulating in the world springs from the mines in Mexico. These mines, however, may be considered at present not only neglected, but really and substantially in a state of embryo, though labour and the application of capital are alone required to develope their established and unquestionable wealth. There are no geological surveys, and the richest district of Mexico—Sonora—is still almost a *terra incognita*. Humboldt gives expression to the prophecy that the time may not be far distant, and especially under sound and secure administration, when Europe may again, as in the the sixteenth century, become inundated with silver. That the quantity hitherto produced may be trebled there can be no doubt, as all who are practically acquainted with the country give a far higher estimate of its capabilities.

Mining in Mexico is carried on in a very crude manner. Generally, whenever the water level is reached, the mines, no matter how rich and promising as regards the future, are abandoned, and others, of a virgin character, and requiring time to open, are taken to by the natives, who prefer the chance of discovering shallow deposits of minerals to the more laborious and expensive, though probably tenfold more profitable, explorations through the aid of machinery in deep mines. Time and experience will remedy this state of things, and probably another half century may find mining enterprise in Mexico carried on with all the improvements and aids of modern skill, the sciences, and the arts. The lodes are found at times so rich that it has been recorded that a single deposit, only 100 ft. long, produced, in six months, 432,274 lbs. troy of silver, valued at 1,000,000*l.* sterling. The great mine of La Luz, in the province of Guanaxuato, yielded annually for five years 1,000,000*l.* profits. There are upwards of 500 mines in Mexico, and between 3000 and 4000 silver veins have been discovered. One of these veins, in the State of Guanaxuato, was wrought to a great depth, and yielded returns and profits of a fabulous amount, when compared with the gains accruing from other industrial pursuits. The geological character of the strata differs in several districts, and presents many curious and interesting phenomena, and especially so to the practical and observant explorer of silver-producing regions. The great central plateau of Anahuac is composed of porphyry, characterised by the constant presence of hornblende, and the almost entire absence of quartz. In other places the deposits occur in sienite. In Guanaxuato—probably the richest mineral district in Mexico—the ores lie in a formation of clay-slate, while in some places they are embedded in transition limestone. The only

veins worked for gold are in Oazaco, where they traverse formations of gneiss and mica-slate. Many of the silver veins contain proportions of gold, which are separated from the silver by the well-known process in metallurgy called "parting." The subject is an interesting one, and, from the data in my possession, I shall take an early opportunity of returning to it.

*London, May* 6. R. TREDINNICK, Consulting Engineer.

## MINING ON THE RHINE—No. I.

SIR,—In Bradshaw's "Continental Guide," page 312, you will find the following notice:—"Rheinbreitbach, on the left bank, is a large village, with castles and towers, at the entrance of a valley, in which are the copper mines of Birnberg and Marienberg, now no longer worked, the largest having been inundated by the river." As these mines are likely again to become the largest in Germany, it may not be uninteresting to give a short notice of them. The mine called in Bradshaw Birnberg is the great Verneberg, or Saint Josephsberg Mine, quite distinct and ½ mile distant from the Saint Marienberg Mine. Attracted partly by this notice, it occurred to your correspondent that a ramble over these old mines, situated on the most picturesque part of the Rhine, might not be an unpleasant May-day excursion; so, leaving Bonn by an early train, he reached the far-famed Rolandseck. Passing the castled heights of Drachenfels, and the Island of Nonnewerth, neither oblivious of Byron's charming lines nor Schiller's beautiful ballad, he went to this village. The castles and towers were certainly a splendid draw upon the imagination. Having called at the house, and there found one of those mining men too seldom met with in our own land, but not uncommon in Germany—not only an excellent practical miner, but a first-class chemist, metallurgist, and mathematician, who reads his Homer and Horace, and can discuss with equal gusto a Greek play or a bottle of Wahlportsheimer—we sallied forth, stick in hand, first to the Saint Marienberg Mine, where we were most courteously received by the manager, shown over the mine, and supplied with every information respecting its past history and future prospects. The Rheinland is celebrated for its legends; and that which I have quoted from Bradshaw you will presently see is one of those facts drawn from imagination, with which guide-books so frequently favour travellers. The Marienberg shaft is about 60 fathoms above the level of the Rhine, having an adit 36 lachters (a lachter is 6 feet 10 inches), and the deepest level 99 lachters from surface. The mine has been worked for more than a century. The stratum is killas, with cross-courses of grauwacke; the lode is a congenial spar, rather harder than one would desire to see in Cornwall or Wales, from 1 to 3 lachters in width, underlying about 2½ ft. in 7, and accompanied by a large flookan of light blue colour, and a band of basalt stone. The mine has been productive from a very shallow level, and continued so until it stopped. From the influx of the Rhine? No; but by its little ricketty 30-inch condensing engine, 7-feet stroke, equal beam, being fairly worn out in the service. The levels have been driven at intervals of 10 lachters from the 10 fathoms under surface, and extended 100 to 250 lachters in length, and produced ores which, in quantity and quality, appear to one accustomed to British mining, almost fabulous. It may not be uninteresting to note that the greatest quantity of water raised was 22 cubic feet per minute; that the drawing-engine was a 12-horse power high-pressure; the two engines fed by four boilers, each 33 feet long by 4 feet in diameter. All the backs are stoped way above the 88; the orey part of the lode has not been cut into in the 99, which has been driven 40 lachters, and, consequently, the productive part of the lode, which above has been 4 to 6 ft. wide, of ore varying from 16 to 23 per cent., is still standing. There has been very little cross-cutting from the higher levels. About two months since, in the south part, near to the Saint Josephsberg Mine, a lode was cut at surface, composed of very rich sulphuret, with a softer spar, and all is again activity. A new shaft has been sunk 7 lachters, the orey part of the lode is 6 ft. to 8 ft. wide, of ore worth, on an average, 13 per cent. The foundation for a new engine-house is excavated, and the works are pressed forward by the energetic and wealthy French and Belgian firm, Estivent Brothers. The clear profits realised on this mine (now only 53 lachters, not 66 fms., under adit), has exceeded 1,000,000*l.* sterling, and it may yet be said to be in its infancy. I hope very shortly to send a notice of its still more remarkable neighbour, Saint Josephsberg.—*Bonn, May* 4. CORRESPONDENT.

## OUR COMMERCIAL POSITION—TRADING COMPANIES AS A MEDIUM OF INVESTMENT.

SIR,—The current events of the year—January to April—will prove both instructive and interesting to each close-thinking and reflective observer of the landmarks presented to view, and more especially so when applied to and as affecting or directing the course of our mercantile and trading interests. The past, present, and future of the ever-varying *status* of this great and powerful commercial country are so entirely blended in their changeful and diversified manipulations that the continuity, advancement, or retrogression of success or failure become identified in their workings, and should in their combined focus and influence be correctly understood and appreciated by those who desire even to comprehend—far less to direct others in—their prospective tendency or action. The chief features of the past should be known to all, for they are recorded and universally diffused to the commonwealth through the broad columns of the daily press. These should be cherished, and the events of the fast-fleeting present carefully culled and preserved; these together should constitute the material necessary to business men for constructing and maturing an accurate and practical sketch of the future.

The decadence of the wild speculation that appeared in all directions during the years 1864-5, and until May, 1866, when the general public, and especially the operators on the Stock Exchange, became overweighted, and, consequently, distrusful of that which they had up to that period regarded as securities, and which subsequent investigation proved, in many cases, to be of no intrinsic worth whatever, while in almost every other instance they became subject to heavy and continued discounts, added to wide and sacrificing fluctuations, based on rumours as ill-founded and corrupt as they were ill-conceived and digested, yet persistent in their aim, and aiding depression, until panic was the universal cry of all, astonishment depicted on every countenance, and few escaped the conviction that their own apathy and indifference brought about the collapse they felt and dreaded. Though too late, they saw that the ordinary precautions of men of business would have guarded against the consequences, had they foresight only but to have exercised them.

The inflated condition of joint-stock banks, the many failures and increased suspensions and embarrassments of others; wide-spread disasters and fire-side dismay, with ruin of many a family and home circle; the false, precarious, and ruinous position of our railroads, affecting the whole community, from the vastness and extent of money and interests involved in their construction and maintenance; the fraudulent creation and mischievous workings of finance and discount companies, with the remaining host of miserable and corrupt joint-stock limited concoctions, injurious and ephemeral in their tendencies and existence, combined to create that apathy and indifference which still prevail in the public mind as to new associations and new enterprises, no matter how tempting the inducements or cheerful the prospects of early success. It is this distrust of the future, engendered from the disasters of the past, that renders the present epoch a most desirable one for the interests of the investing public. The salutary lessons learnt from the history of the inflated values of all descriptions of property during the years preceding the awful collapse of 1866 have opened the eyes of the monied classes to the dangers of over-trading, and the crippling effects of analysing the real worth of securities have brought to light their merits—hence the market is gleaned of that which is corrupt and visionary, whilst all which is actually valuable and *bona fide* is reduced to its legitimate standard, and, in many instances, quoted at prices far below. We would, therefore, add that the tone and character of the securities now open to the public for selection are far more sound, *bona fide*, and healthy than we remember them at any former period, whether we regard them in respect to market value, yield of interest, or permanency of prospective success. There can be no question entertained as to the soundness of our home and colonial trade. It is true that cotton and woollens have greatly fallen in value, but the bulk manufactured and exported far exceeds the corresponding date of last year, and even equals the amount of that inflated year 1865-6, when trade and speculation ran riot in every direction and in every article of commerce. Our home industries, consequent on high prices of consumption, have suffered much, and our labouring population have severely felt the infliction; on the whole, the working masses have, however, shown great forbearance—still, in a few instances, and in exceptional cases, there have been strikes and combinations betwixt masters and men, that have led to unhappy differences and much privations to the latter and their families. The railways of this country must be further extended to open out and facilitate the resources and locomotion of trade and commerce, so as to compete with the marts of the world, and if they do not pay at existing tariffs the Legislature must allow higher charges hereafter to be made, and the general public must be heavier taxed, so as to enable the companies to pay fair and remunerative interest to shareholders for capital required. This is a question, however, as affects the future, and cannot in any way be applied to the money already expended; hence, we apprehend that, so far as existing companies are concerned, many and grievous revelations have yet to become disclosed that will seriously and adversely affect the ruinous depression already prevailing in this description of property. Next, joint-stock banks must be regarded as trading companies, and, as the history of the past exhibits so many failures, they must be regarded as peculiarly pregnant with hazards, and, consequently, should be watched with anxiety, and always realised by the cautious capitalist whenever dividends fall below 10 per cent. per annum. The finance and discount companies are too conflicting in their interests and dealings to allow of any general reference to them as desirable or even questionable mediums for the investment of capital in shares. The public would act prudently, therefore, in embarking only in those with which they have peculiar means of ascertaining the true position and state of affairs. The miscellaneous securities worthy of notice embrace the East and West India Docks, Indian railways and debentures, Colonial Government securities, foreign stocks, French railways, and the insurance, gas, and water companies, many of which pay good, and in all probability permanent, dividends. Lastly, we would draw attention to our home mines. The list presented at this moment to the public is choice and select indeed, and combines freshness and elasticity with a healthy vigour hitherto unknown in such securities. We allude to, of course, the West Chiverton, 62*l.* to 64*l.*; Herodsfoot, 38*l.* to 40*l.*; and Mary Ann, 21*l.* to 22*l.*—all situate in Cornwall, and valuable profitable dividend lead mines. The Great Laxey, Isle of Man; Minera, near Wrexham; Bwlch Consols, near Aberystwith; the Llangynog, and others in Wales—with South Caradon, West Seton, New Seton, Emily Henrietta, Carn Brea, South Crofty, and South Frances, in Cornwall, with a few other young and advancing enterprises that present all the spring and promise of early prizes. This latter description is well worthy the attention of the speculative miner, and attests forcibly the motto of every true-bred Cornishman—*Nil desperandum*—being applicable especially to this class of our home industries, for one deposit after another being laid open of the hidden wealth proves that no obstacle can retard or daunt the energies of the hard-working and persevering miner in his onward and untiring progress to success; and that, notwithstanding the immense yield of our Cornish copper and tin mines, the development of our mineral veins in depth establishes the fact that minerals grow faster than they are extracted—whilst, from discoveries made, there is no fear of even approaching exhaustion in Cornwall, even for ages yet to come.

*London, May* 6. R. TREDINNICK, Consulting Engineer.

## THE PROGRESS OF MINING—AS A SCIENCE, AND SOURCE OF COMMERCIAL WEALTH.

SIR,—The Frongoch Mine, Cardiganshire, is a comparatively new mine; 50 years ago it is probable that the turf which covered the vein had never been disturbed for mining purposes; this is singular in a country that has been worked for mining for nearly 2000 years, more especially as this is one of the largest lodes, and one of the best mines in the county. This mine was discovered under the direction of Messrs. Richard and John Elliston, gentlemen who had settled on some part of the estate of the Earl of Lisburne, from Yorkshire, for agricultural purposes, but who afterwards directed their attention to the fascinating pursuit of mining, and both were rewarded by very profitable results. The lode of the Frongoch Mine is an extraordinary one, bearing its ore in rich deposits for a width of upwards of 30 ft. Along its surface there are outcrops of very rich gossan, hence the name of the mine—Frongoch—signifying the red side of a hill. One of these gossan formations, opposite the old account-house, is, I think, the richest gossan I ever saw; the whole ferruginous mass is 15 to 20 ft. wide, containing the chromates of lead and iron, shining with metallic lustre in every stone. If all indications of lodes were as well marked as this, we should have fewer discussions as to whether anything certain could be said of the interior of lodes from the appearances at surface, for I venture to affirm that not one miner out of a hundred would hesitate to pronounce in favour of this proving a great mine before a stone of ore was broken, so that it is obvious that, at least in some cases, the fortunes of a mine may be pretty well predicted at the commencement. At the same time, it is fair to add that had the discoverer only gone about 50 yards further eastward he would have found the whole lode covered to the depth of 22 yards by gravel and alluvial deposit, and possibly his best efforts would have been frustrated or delayed; and to the westward, within a few fathoms, the lode is so filled with clay that levels at the depth of 24 fms. had to be opened through it by means of timber, while 300 fms. further east, at the spot known by the rather unpronounceable name of Llwynwnwch, the back of the lode for 16 ft. wide is composed of solid black jack or blende, the ore of zinc. The company (the Messrs. Taylor and Sons) now working the mine so prosperously commenced operations about 33 years ago; the engine-shaft was then sinking under the 24 fm. level; a winze was sinking opposite the engine-shaft, at the end of a cross-cut 7 or 8 fms. long, in which there was a good course of lead ore about 2 ft. wide, and in no part of the mine had the ore been opened to a width of more than 3 ft., although it existed in masses 33 ft. wide.

The reason why the workmen and agents were in such total ignorance as to the value of the mine was that the direction of the workings had never been dialled, but when the lines of the ore ground were laid down, they were found to occupy a zig-zag traverse between two walls 33 ft. apart, and when the remaining parts of the lode began to be worked, the returns of the mine immediately jumped from 16 tons up to 100 tons a month. The profits have continued ever since very large, and the returns increasing. It was attempted for a long time to work this mine by water-power alone; formidable water-engines were erected, reservoirs of great extent made, and most of the brooks to the west of the Devil's Bridge diverted and impounded, but all would not do, and the mine is now drained by a large Cornish steam-engine; and taking into account the stoppages attending water-power in summer and winter, it is doubtful whether water-power is always so economic as it appears. To the west of Frongoch, for a mile, the lode yields good bunches of ore at Graigoch, Cwmnwyddion, and in the intermediate ground, but the gossan and surface indications are harder, and more crystallised, and not so assuring as to the result as Frongoch proper. The mine, I suppose, is now nearly 150 fathoms deep, or some little distance below the sea-level. In Cornwall, with such a splendid lode, this would be considered to be only a shallow mine. One thing now greatly in favour of the mines of this county, which will, in many cases, have to adopt steam-power for deep pumping, is the introduction of railways, one of which, the Milford and Manchester, passes within five miles of this excellent mine, and between it and the River Ystwyth run through a bank, 600 feet high, the great lodes of Grogwinion Mine—a mine worked by the Romans, and very productive home to the close of the last century. As this is an adit level mine, there can be no doubt, when the modern appliances of mining are judiciously adopted, that it will become one of the most productive, as it is now one of the most extensive mines in the district, as has been the case with the sister mine of Frongoch. M. F.

## THE NEW QUEBRADA COMPANY.

SIR,—An extraordinary meeting of the shareholders of this company (convened by the requisition of those whose desire seemed to be to supplant the present directors rather than to co-operate with them) was held in the early part of March. The requisitionists, according to the report of the details of the meeting, as published in the Journal, suffered an ignoble defeat, the shareholders wisely, I think, testifying by their votes that they were perfectly content with their present administrators, although everything had not progressed in that completely satisfactory way that could have been desired. As showing that the directors had not opposed the apparently self-abnegatory clamour on the part of the requisitionists for the appointment of a committee of investigation, because they feared investigation, the issue showed, for as soon as the motion as emanating from the "indignant proprietors" had signally failed, the Chairman (Mr. Stock, M.P.) proposed, on behalf of the board, that a committee of conference or consultation should be appointed. The result was that the following gentlemen were chosen as the shareholders' representatives:—Messrs. James Thompson, Mr. G. L. Browne (the late Chairman of the company), T. Rotten, A. Currie, R. Hurst, T. Styring, A. Peglar, and T. Clapham.

As to the efficacy of committees, whether they be designated "investigation," "conference," or "consultation," my experience has taught me to endorse the opinion some time since expressed by Mr. Potter—than whom few men have had a larger or more diversified association with all sorts of companies, but more particularly with railways and collieries. Mr. Potter once said at a meeting of an influential company, when it was proposed to appoint a committee of shareholders, that "he had a perfect horror of even the name of a committee, for any committee, unless it be entirely neutral, and took what might be termed a philosophic view of the affairs of a company, was invariably a mere illusion. Generally, a committee followed the impulse of those who called it into existence, and a division was the obvious result." Anyone who has any experience at all with the working of committees will readily ratify the above statements; but as the shareholders of the New Quebrada Company, conforming to the solicitations of the Chairman, did appoint a committee of conference, we outside shareholders naturally ask ourselves what are they about? Have they gone to Venezuela to assist in the completion of the railway to Palma Sola, or are they passively "resting on their oars" until another Mr. Gledhill shall arouse them from their seeming inanition?

Time is rapidly on the wing, the capital is gradually becoming more circumscribed, and the anxiety of shareholders increases in the same ratio; therefore Committee of Conference, speak! A COUNTRY SHAREHOLDER.

## ST. JOHN DEL REY GOLD MINING COMPANY.

SIR,—I hardly think that your correspondent, writing in last week's Journal under the title of "A Shareholder," was altogether justified in his conclusions that no one has a right to publicly express an opinion as to the value and prospects of this mine, unless he be a shareholder. Your correspondent ignores the judicial dictum "*Audi alteram partem*," which it is admitted on all hands is the only safe basis upon which to found an opinion; and would have us regard the question as to the present condition of the Bahu Mine as exclusively a matter for the consideration of the *present* shareholders. But supposing your correspondent, "A Shareholder," had been fortunate, or if you like, far-seeing, enough to have sold his interest at (say) 65*l.* per share, not so much with the intention of ever remaining out of the company as to take a legitimate advantage of what he may have probably considered an undue market value, by what means, I would ask, is it possible for him now to obtain data whereby to form any correct opinion upon the subject, other than by an unrestrained discussion? Even "A Shareholder," I should imagine, would not be actuated in his operations by the advice of a "bullish" jobber in the shares, whose only object, of course, would be to make as good a bargain as he could with the shares he had previously purchased on his own account.

"A Shareholder" should bear in mind, too, that this has now become a question of great interest to the mining public at large, and that dealing in generalities is *not* a confutation of the statements made by the previous writer, whom he has, I think, unjustly attacked. The principal points to be discussed are—

1.—As perpendicular shafts *must* be sunk to re-open the Bahu Mine, whether it is expedient to incur the outlay, which will be spread over a period of not less than seven years.

2.—As the average yield must not be less than 2¾ ozts. of gold per ton of ore to cover the cost of raising and extraction, whether loss is not being sustained by a continuance of the present stamping operations, the average yield of gold being under 2 ozts. per ton.

3.—As the company possesses a large area of property, whether the more politic course would not be to forego the idea of re-opening the old mine, and concentrate the operations upon some favourably situated undeveloped portion of the sett.

These are the main points which should be brought out to enable the outside public to base any conclusion. ONCE A SHAREHOLDER.

## ST. JOHN DEL REY GOLD MINING COMPANY.

SIR,—Your correspondent, "Shareholder," does not attempt to confute or deny the vital question in my letter, in the Journal of April 18—that "the mine had collapsed," but rather attempts to insinuate that my not appearing a registered shareholder on the books of the company renders my advice and assertions unworthy of consideration, and that his *taurian* hopes are to be the guide of the shareholders and directors. Be it so; let the vain dream of ever seeing the bottom of St. John del Rey Mine buoy on the adventurers, and no *ignis fatuus* ever proved more fatal than this will,—the waste of what assets the company possesses, which your correspondent says amount to 50,000*l.* I hope it is so—that the advances on the Newcastle property, the railway debentures, &c., will realise cost price: I doubt it. The fact of the mine having returned 250,000*l.* is in its present position an argument against it ever again being alike profitable. To any persons conversant with mining enterprise it is unnecessary to point out the great discredit that has fallen upon mining as a legitimate pursuit from the excessive losses that too frequently accompany the endeavour to re-work old and abandoned mines.

I have carefully read the last official reports from the mines, and must say, with regret, I see not a word in them breathing the faintest hope of a better state of things than at present exists. This opinion is not shaken by the evidence of miners and others, who are leaving the mines and returning to England by every mail. "Shareholder" says that the cost will be reduced. No one doubts this, but how long a time must elapse ere the company's agreements with the miners expire. What compensation will be required? How soon can the 600 slaves employed in the mines (owned by the shareholders) be turned adrift, having no work for them? Does "Shareholder" calculate that the proceeds of the sale of these poor wretches will swell his dividend, or enable him the longer to continue the pursuit of his El Dorado?

The reports of Gaia, or any other new part, would be just as valuable, were the heavy costs reduced, as East del Rey, Anglo-Brazilian, or any other unproved and unprofitable concern. As to the backwardation paid on the shares from account to account, this, and the regular drop in the price during the same time, are evidences that shareholders are awaking to the real state of the property, which has been long known to those who were fortunate enough to sell the shares, and who are at this moment the only parties to relieve the unfortunate shareholders of what will soon be of a much less marketable value.

H. WADDINGTON.

## ST. JOHN DEL REY GOLD MINING COMPANY.

SIR,—Having recently seen two letters on this subject in the *Mining Journal*, I beg the favour of a little of your valuable space for a few remarks. I have been a considerable sufferer by mining adventures—principally from "imperfect ventilation," not of the mines themselves, but of the general property and affairs of the companies: therefore, I consider that the writer of the first letter deserves the best thanks of shareholders in the St. John del Rey Mines for calling attention to their present serious position. The statements made by Mr. Waddington are, I fear, too true, as a "Shareholder," who acknowledges having taken some trouble in the matter, after all his pains is unable virtually to contradict a single one of them. A "Shareholder's" letter, for whatever purpose intended, did not have a "bullish" effect, but the contrary.

The course recommended by Mr. Waddington is undoubtedly a wise one—that of sending some competent recognised authority to inspect and impartially report on the actual state of the property: in the meantime, suspend all expensive operations. I would urge upon the directors the desirability of calling a meeting for the purpose of considering the above plan. Anyone possessed of the reports, and acquainted with the enormous working expenses, can easily calculate for themselves, and see how desirable such a course, or some other more decisive one, would be. I would ask whether a large uncalled up capital is likely to prove an advantage or otherwise, by prolonging the present state of affairs?

A LOOKER-ON.

[For continuation of Original Correspondence, see this day's Journal.]

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